

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

SOUTHWEST DISTRICT

TAMPA BAY TRIBUTARIES BASIN

TMDL Report Fecal and Total Coliform TMDLs for Flint Creek (WBID 1522A)

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Web sites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

<http://www.dep.state.fl.us/water/tmdl/index.htm>

Identification of Impaired Surface Waters Rule

<http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf>

STORET Program

<http://www.dep.state.fl.us/water/storet/index.htm>

2002 305(b) Report

http://www.dep.state.fl.us/water/docs/2002_305b.pdf

Criteria for Surface Water Quality Classifications

<http://www.dep.state.fl.us/legal/rules/shared/62-302t.pdf>

Basin Status Report for the Tampa Bay Tributaries Basin

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Water Quality Assessment Report for the Tampa Bay Tributaries Basin

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Allocation Technical Advisory Committee (ATAC) Report

<http://www.dep.state.fl.us/water/tmdl/docs/Allocation.pdf>

U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida
<http://www.epa.gov/region4/water/tmdl/florida/>

National STORET Program
<http://www.epa.gov/storet/>

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Loads (TMDLs) for fecal and total coliforms for Flint Creek in the Hillsborough River watershed, within the Tampa Bay Tributaries Basin. The river was verified as impaired for fecal and total coliforms, and was included on the Verified List of impaired waters for the Tampa Bay Tributaries Basin that was adopted by Secretarial Order on May 27, 2004. Flint Creek is located in western Hillsborough County near Lake Thonotosassa (**Figure 1.1**). The TMDL establishes the allowable loadings to Flint Creek that would restore the waterbody so that it meets its applicable water quality criteria for fecal and total coliforms.

1.2 Identification of Waterbody

For assessment purposes, the Florida Department of Environmental Protection (the Department) has divided the Tampa Bay Tributaries Basin into water assessment polygons with a unique **waterbody identification** (WBID) number for each watershed or stream reach. The Tampa Bay Tributaries Basin has been divided into 277 segments, as shown in **Figure 1.1**, and this TMDL addresses the following WBID:

WBID 1522A, Flint Creek – for fecal and total coliforms.

The Flint Creek segment (WBID 1522A) is located in Hillsborough County, has a surface area of 4.2 square miles, and an overall drainage area of 60 square miles that reaches into Lake Thonotosassa, Campbell Branch, and Hollomans Branch (**Figure 1.2**). The river is 2.3 miles in length and flows from Lake Thonotosassa to the Hillsborough River. Tampa, a city of 303,447 (2000 U.S. Census) is approximately 14 miles southwest, and Plant City, a city of 29,915 (2000 U.S. Census), is approximately 8 miles southeast of Flint Creek. Along its length, Flint Creek exhibits characteristics associated with riverine aquatic environments. Additional information about the river's hydrology and geology are available in the Basin Status Report for the Tampa Bay Tributaries Basin (Florida Department of Environmental Protection, March 2003).

Figure 1.2. Location of the Tampa Bay Tributaries Basin and Major Geopolitical Features

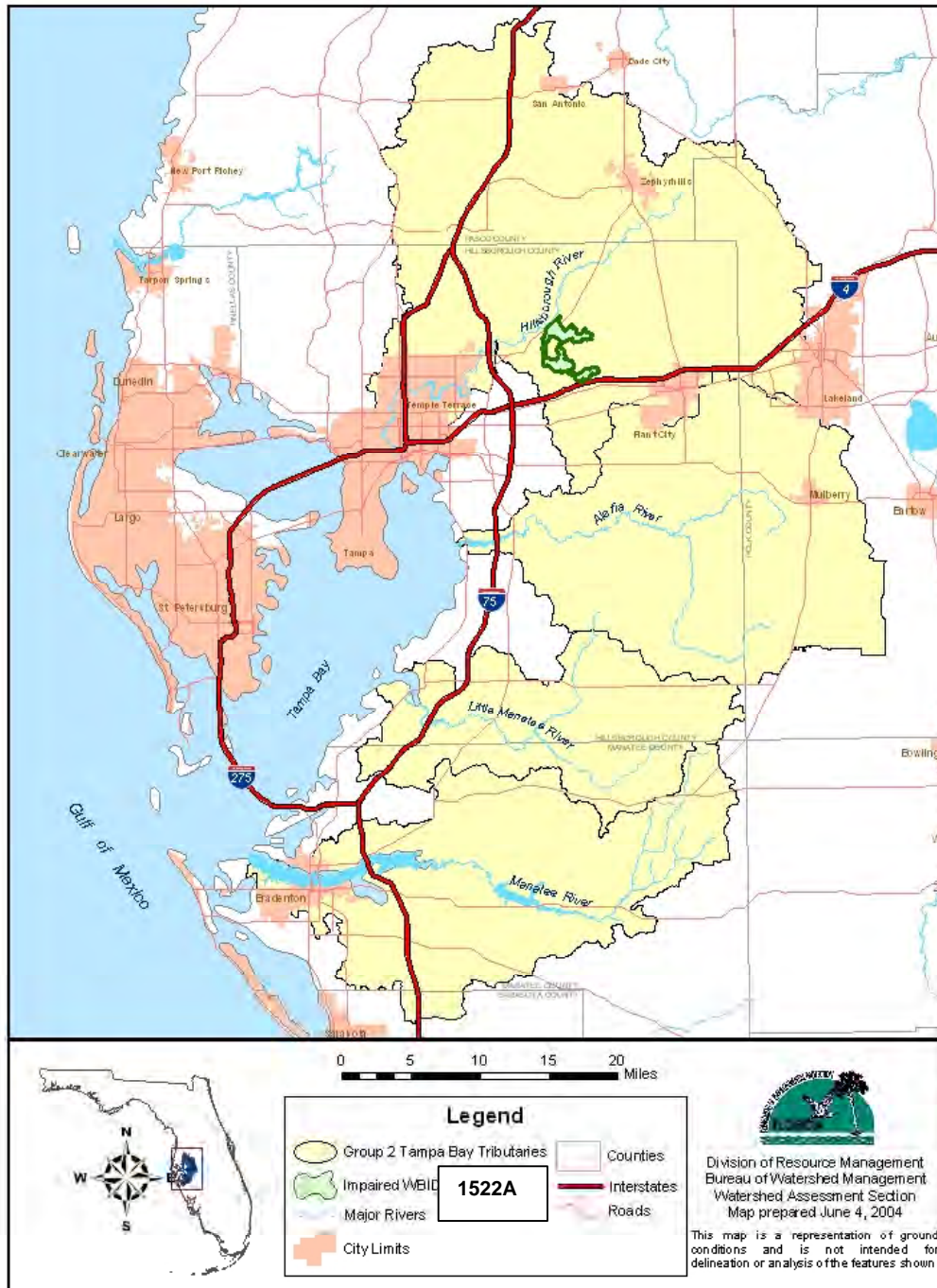
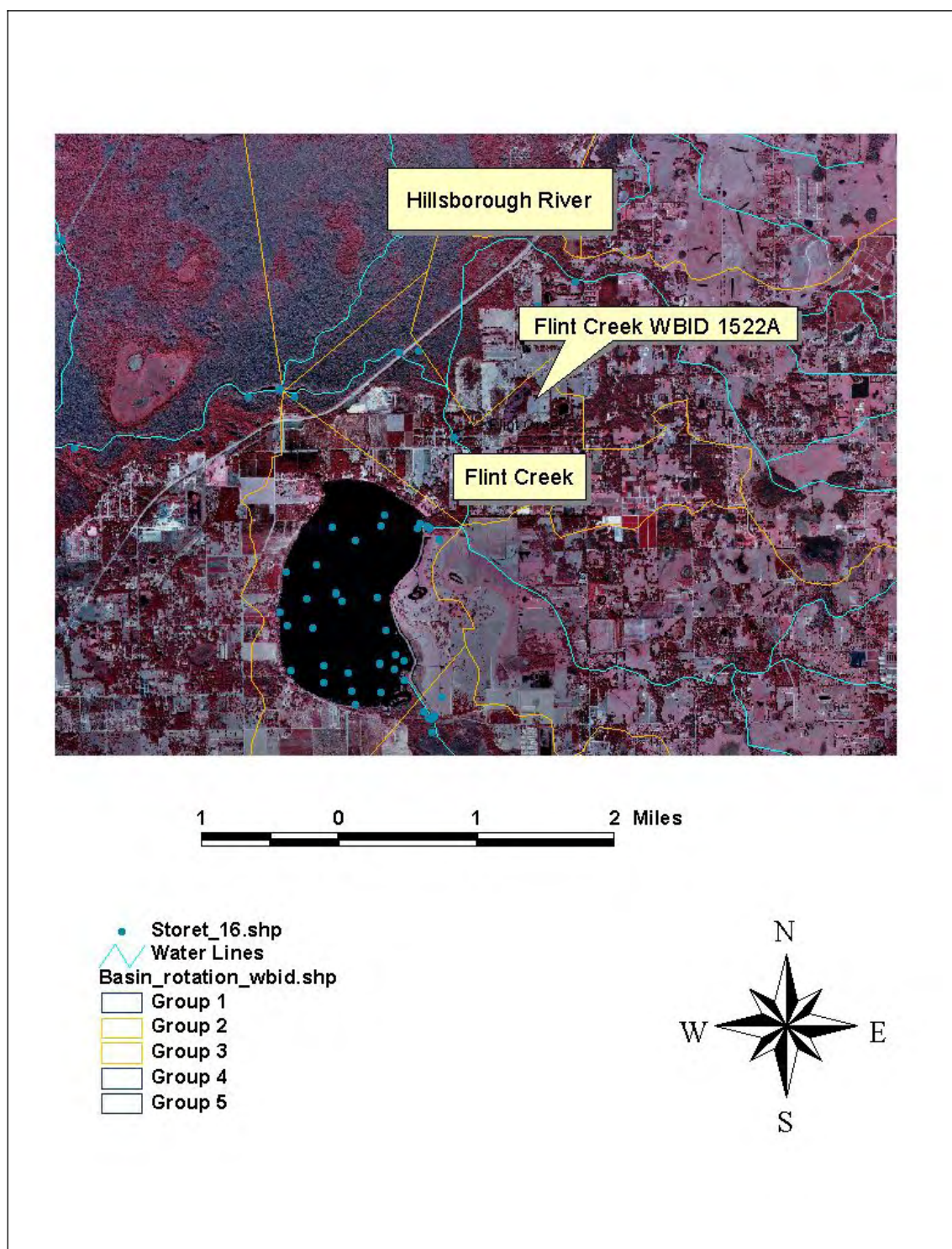


Figure 1.2. Location of Flint Creek, WBID 1522A, and Major Surface and Water Features in the Watershed



1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program—related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA, Chapter 99-223, Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. TMDLs provide important water quality restoration goals that will guide restoration activities.

This TMDL Report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of fecal and total coliforms that caused the verified impairment of the Flint Creek waterbody segment WBID 1522A. These activities will depend heavily on the active participation of the Southwest Florida Water Management District, local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant source in each of these impaired waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]).

Florida's 1998 303(d) list included 43 waterbodies in the Tampa Bay Tributaries Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rule-making process, the Environmental Regulation Commission adopted the new methodology as Chapter 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001.

2.2 Information on Verified Impairment

Table 2.1 summarizes fecal and coliform measurements for the Flint Creek WBID during the planning and verified periods (Planning Period 1/1/1991 – 12/31/2000; Verified Period 1/1/1996 – 6/30/2003). Fecal and total coliform observations over the 1991 – 2002 period are plotted in **Figures 2.1** and **2.2**, respectively. The thresholds for impairment for both fecal and total coliforms were exceeded during both the planning and verified periods.

Measurements were sorted by month and season (the calendar year was divided into quarters) to determine whether there was a temporal pattern of exceedances. Monthly rainfall data from Tampa were also obtained and included in the analysis. **Tables 2.2** and **2.3**, respectively, present summary statistics by month and season for fecal and total coliform measurements. Historically (and during the period of this analysis), July through September are the months with the highest rainfall; July and September had the largest percent exceedance for fecal coliforms, while June and September had the largest percent exceedance for total coliforms. With respect to the seasonal statistics, summer (July – September) had the largest exceedance level for both fecal and total coliforms. This information is also shown graphically in **Figure 2.3**. Linear regression with the coliform exceedance percentage versus rainfall and/or month (or season) was not statistically significant at the 0.05 alpha level.

Table 2.1. Verified Fecal and Total Coliform Impairments
for Flint Creek, WBID 1522A

Type	Class	1998 303(d) Parameters of Concern	Parameters Assessed Using the Impaired Surface Waters Rule	EPA's Integrated Report Category	Comment (# Exceedances/# Samples); PP=Planning Period, VP=Verified Period ⁽¹⁾
Stream	IIIF	Coliforms	Coliforms (Fecal Coliform)	Cat. 5	PP - 38/113 Potentially impaired; VP - 18/77 Verified impaired
Stream	IIIF	Coliforms	Coliforms (Total Coliform)	Cat. 5	PP - 34/119 Potentially impaired; VP - 21/71 Verified impaired

(1) Planning Period (PP) – January 1, 1991 to December 31, 2000; Verified Period (VP) – January 1, 1996 to June 30, 2003.

F – Fresh water.

Figure 2.1. Fecal Coliform Observations in Flint Creek,
WBID 1522A, January 1991 – December 2002

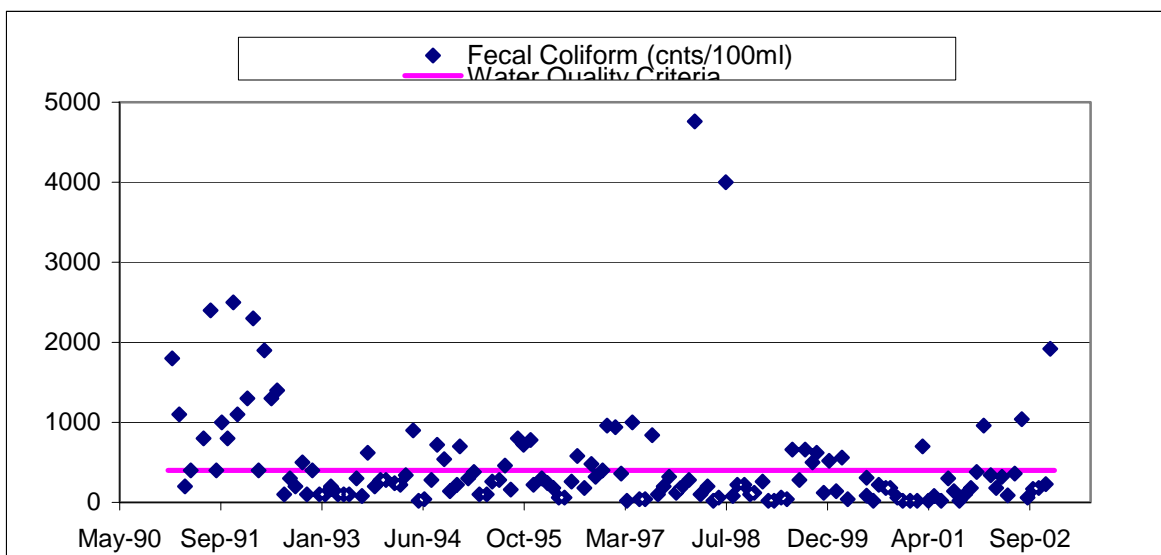


Figure 2.2. Total Coliform Observations in Flint Creek,
WBID 1522A, January 1991 – December 2002

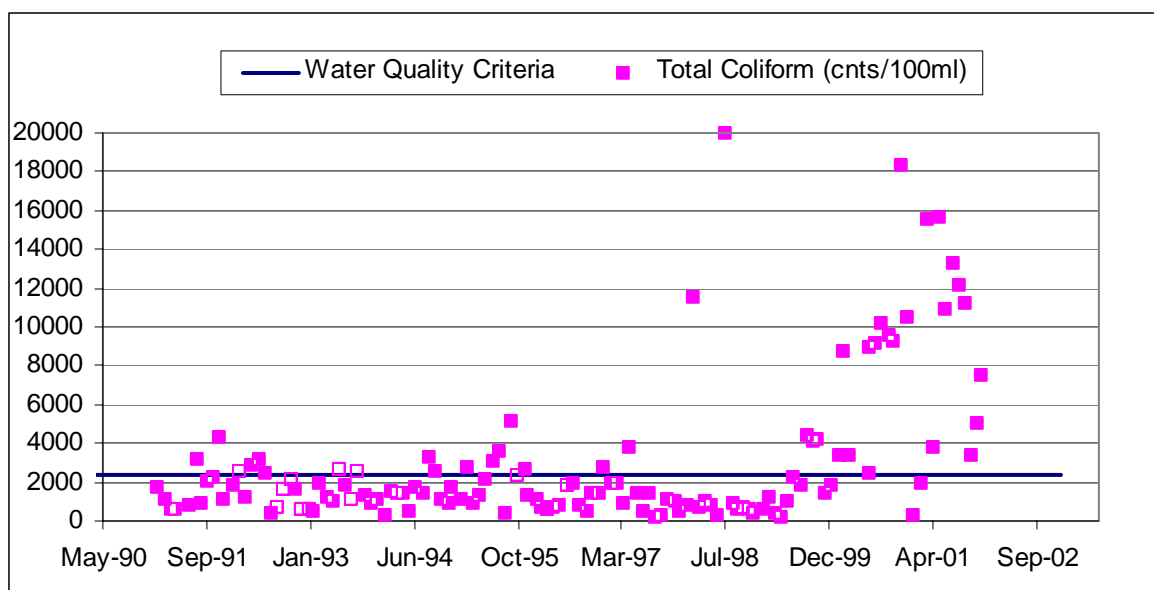


Table 2.2. Summary Statistics of Fecal Coliform Data for
Flint Creek, WBID1522A, by Month and Season

Month	No. of Cases	Minimum	Maximum	Median	Mean	# Exceedances	% Exceedances	Rainfall Mean
1	13	20	1800	280	518.46	4	30.77	2.95
2	13	20	4760	360	976.92	1	7.69	2.43
3	13	20	700	180	204.62	1	7.69	2.81
4	11	20	1900	200	460.00	3	27.27	2.60
5	11	20	30000	80	2910.00	2	18.18	1.65
6	15	20	1400	260	318.27	3	20.00	5.80
7	12	20	4000	380	883.33	6	50.00	7.05
8	14	60	720	170	248.57	2	14.29	7.40
9	14	20	1000	350	410.71	7	50.00	6.48
10	14	100	800	320	394.29	6	42.86	2.67
11	12	60	2500	200	424.17	2	16.67	1.15
12	13	20	1920	400	553.85	5	38.46	3.27
Season	No. of Cases	Minimum	Maximum	Median	Mean	# Exceedances	% Exceedances	Rainfall Mean
Winter	39	20	4760	240	566.67	10	25.64	2.73
Spring	37	20	30000	100	1130.92	8	21.62	3.62
Summer	40	20	4000	290	495.75	15	37.50	6.97
Fall	39	20	2500	280	456.67	13	33.33	2.40

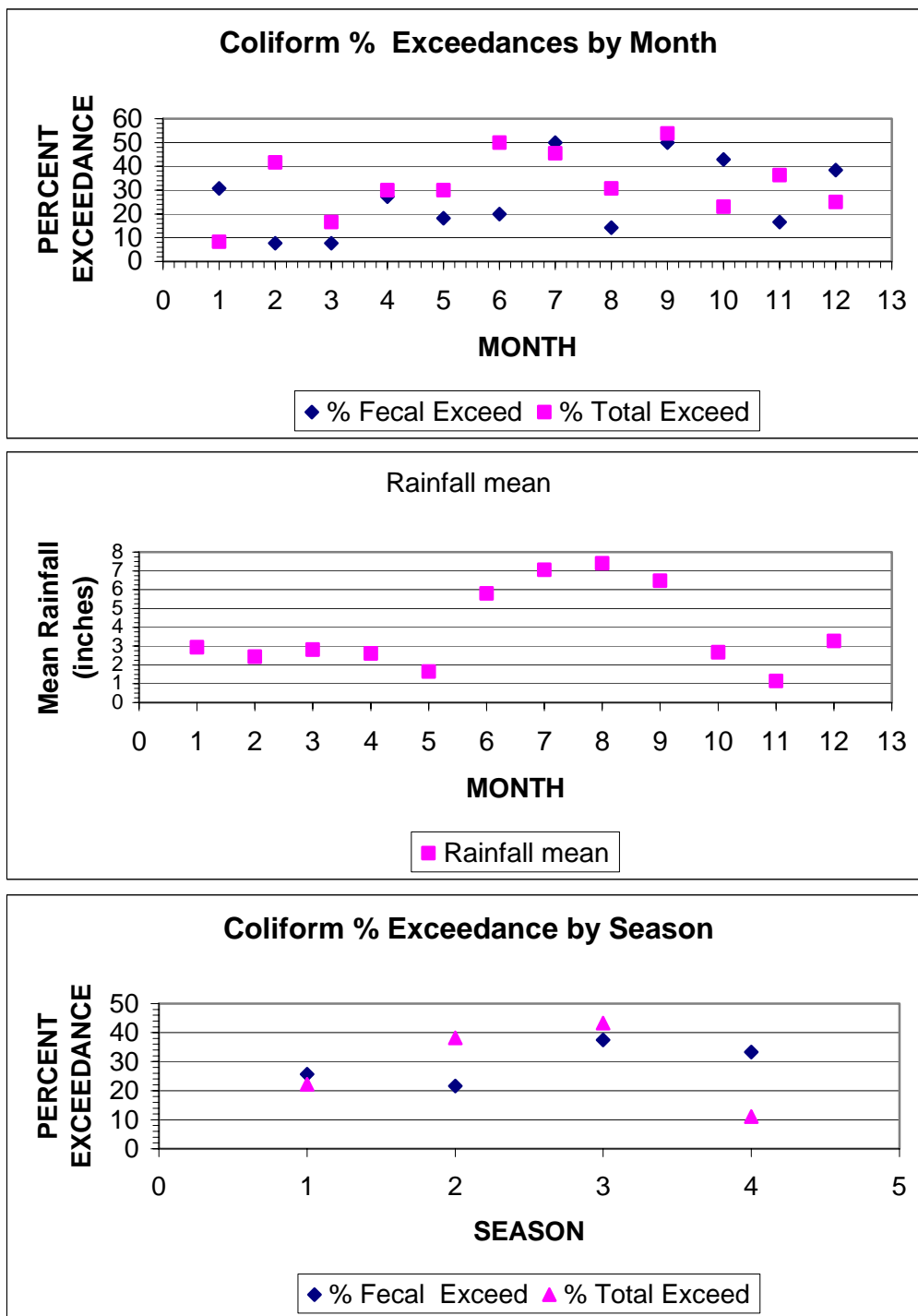
Fecal coliform units are colonies/100 mL. Rainfall units are inches per month.

Table 2.3. Summary Statistics of Total Coliform Data for
Flint Creek, WBID 1522A, by Month and Season

Month	No. of Cases	Minimum	Maximum	Median	Mean	# Exceedances	% Exceedances	Rainfall Mean
1	12	300	3400	3400	1208.33	1	8.33	2.95
2	12	500	11500	2000	3108.33	5	41.67	2.43
3	12	400	15600	900	2358.33	2	16.67	2.81
4	10	200	3800	1250	1690.00	3	30.00	2.60
5	10	500	30000	1200	5660.00	3	30.00	1.65
6	14	300	10900	2400	3064.29	7	50.00	5.80
7	11	400	20000	2000	5300.00	5	45.45	7.05
8	13	200	12200	900	2838.46	4	30.77	7.40
9	13	300	11200	2600	3446.15	7	53.85	6.48
10	13	700	9300	2200	2615.38	3	23.08	2.67
11	11	600	18400	1400	3481.82	4	36.36	1.15
12	12	400	10500	1200	2508.33	3	25.00	3.27
Season	No. of Cases	Minimum	Maximum	Median	Mean	# Exceedances	% Exceedances	Rainfall Mean
Winter	36	300	15600	1150	2225.00	8	22.22	2.73
Spring	34	200	30000	1850	3423.53	13	38.24	3.62
Summer	37	200	20000	1900	3783.78	16	43.24	6.97
Fall	36	400	18400	1500	2844.44	4	11.11	2.40

Total coliform units are colonies/100 mL. Rainfall units are inches per month.

Figure 2.3. Coliform Exceedances for Flint Creek, by Month and Season, and Corresponding Monthly Mean Rainfall, 1991 – 2002



Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	Potable water supplies
Class II	Shellfish propagation or harvesting
Class III	Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV	Agricultural water supplies
Class V	Navigation, utility, and industrial use (there are no state waters currently in this class)

The Flint Creek is a Class III waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criteria applicable to the impairment addressed by this TMDL are fecal and total coliforms.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria and total coliform bacteria concentrations. The water quality criteria for protection of Class III waters, as established by Chapter 62-302, F.A.C., are as follows:

Fecal Coliform Bacteria:

The most probable number (MPN) or membrane filter (MF) counts per 100 mL of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day.

Total Coliform Bacteria:

The MPN per 100 ml shall be less than or equal to 1,000 as a monthly average nor exceed 1,000 in more than 20 percent of the samples examined during any month; and less than or equal to 2,400 at any time.

For both parameters, the criteria state that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. During the development of the TMDLs (as described in subsequent sections), there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for either fecal coliform or total coliform bacteria. Therefore, the criterion selected for the TMDLs was not to exceed 400 in 10 percent of the samples.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of nutrients in the Flint Creek watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either “point sources” or “nonpoint sources.” Historically, the term point sources has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term “nonpoint sources” was used to describe intermittent, rainfall driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA’s National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term “point source” will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) and stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of Coliform Bacteria in the Flint Creek Watershed

4.2.1 Point Sources

No permitted wastewater treatment facilities discharge bacterial loads either directly or indirectly into the Flint Creek watershed.

Municipal Separate Storm Sewer System Permittees

Phase 1 or Phase 2 MS4s. Within Hillsborough County, the stormwater collection systems owned and operated by Hillsborough County Public Works, the city of Plant City, and the Florida

Department of Transportation) District 7 are covered by an NPDES Municipal Separate Storm Sewer System (MS4) permit (Phase I Permit Number FLS000006).

4.2.2 Land Uses and Nonpoint Sources

Additional coliform bacteria loadings to Flint Creek are generated from nonpoint sources in the watershed. Potential nonpoint sources of coliforms include loadings from surface runoff, wildlife, livestock, pets, and leaking septic tanks.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 1999 land use coverage (scale 1:40,000) contained in the Department's geographic information system (GIS) library. Land use categories in the watershed were aggregated using the simplified Level 1 codes tabulated in **Table 4.1a** (**Table 4.1b** lists land use aggregated to Level 3). **Figure 4.1** shows the acreage of the principal land uses in the watershed. At the Level 1 aggregation, over 47 percent of the WBID was in cropland and pastureland, followed by nearly 27 percent in low-density residential. Approximately 18 percent of the land use was categorized as stream and lake swamps. At Level 3, the cropland and pastureland category is represented by three primary uses: tree crops (24 percent), cropland and pastureland (18 percent), and nurseries and vineyards (3.8 percent).

Table 4.1a. Level 1 Land Use Summary for Flint Creek,
WBID 1522A

WBID 1522A, Level 1 Land Use, 1999

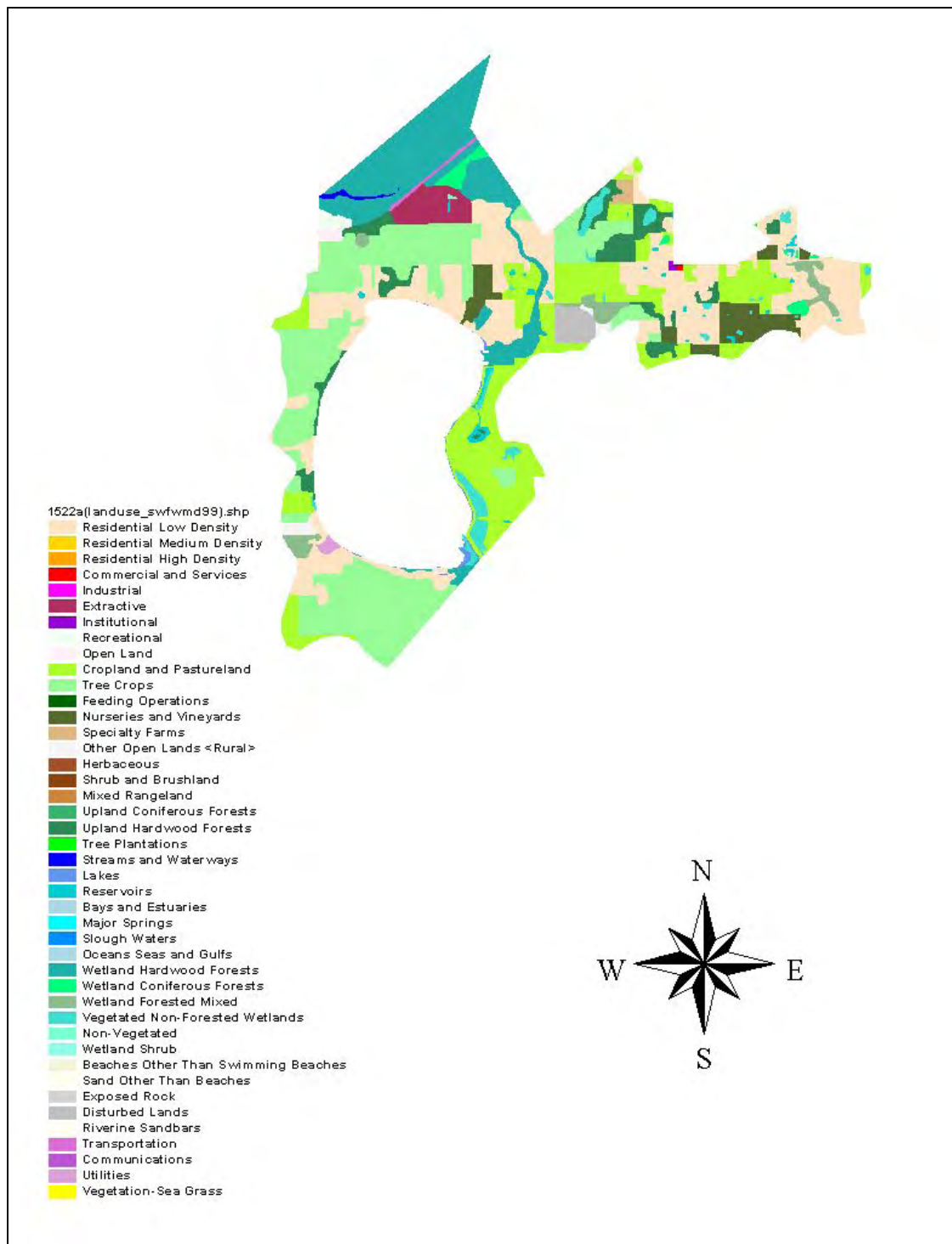
Level 1	Count (polygons)	Attribute	Perimeter (meters)	Area (square meters)	Area (acres)	Area (square miles)	Percentage
1000	22	Residential Low Density < 2 Dwelling Units	51,426.75	2,906,391.85	717.9	1.1213	26.62
2000	41	Cropland and Pastureland	73,555.12	5,169,101.05	1,276.8	1.9943	47.35
4000	13	Hardwood Conifer Mixed	16,362.15	509,984.09	126.0	0.1968	4.67
5000	48	Streams and Waterways	15,815.44	137,025.56	33.8	0.0529	1.26
6000	47	Stream and Lake Swamps (bottomland)	39,204.17	1,998,322.39	493.6	0.7710	18.30
7000	1	Disturbed Land	1,451.05	136,146.96	33.6	0.0525	1.25
8000	2	Transportation	2,972.85	60,424.34	14.9	0.0233	0.55
		TOTAL	200787.52	10917396.24	2696.6	4.2121	100.00

Table 4.1b. Level 3 Land Use Summary for Flint Creek,
WBID 1522A

WBID 1522A, Level 3 Land Use, 1999

Level 3	Count (polygons)	Attribute	Perimeter (meters)	Area (square meters)	Area (acres)	Area (square miles)	Percentage
1100	16	Residential Low Density < 2 Dwelling Units	46,501.52	2,577,948.42	636.8	0.9946	23.61
1400	1	Commercial and Services	250.53	3,895.80	1.0	0.0015	0.04
1600	2	Extractive	2,615.78	241,363.32	59.6	0.0931	2.21
1700	1	Institutional	337.94	6,324.17	1.6	0.0024	0.06
1800	1	Recreational	986.13	48,176.40	11.9	0.0186	0.44
1900	1	Open Land	734.85	28,683.74	7.1	0.0111	0.26
2100	16	Cropland and Pastureland	35,295.97	1,965,956.08	485.6	0.7585	18.01
2140	2	Row Crops	1,566.34	55,693.18	13.8	0.0215	0.51
2200	14	Tree Crops	25,853.31	2,626,704.55	648.8	1.0134	24.06
2400	5	Nurseries and Vineyards	7,762.67	416,357.48	102.8	0.1606	3.81
2500	1	Specialty Farms	1,004.28	39,583.84	9.8	0.0153	0.36
2600	3	Other Open Lands <rural>	2,072.56	64,805.92	16.0	0.0250	0.59
4340	12	Hardwood Conifer Mixed	16,260.23	509,530.84	125.9	0.1966	4.67
4400	1	Tree Plantations	101.92	453.25	0.1	0.0002	0.00
5100	1	Streams and Waterways	1,739.82	26,677.05	6.6	0.0103	0.24
5200	26	Lakes	8,067.25	35,229.48	8.7	0.0136	0.32
5300	21	Reservoirs	6,008.37	75,119.03	18.6	0.0290	0.69
6150	7	Stream and Lake Swamps (bottomland)	17,540.92	1,421,889.02	351.2	0.5486	13.02
6200	3	Wetland Coniferous Forests	663.63	7,304.61	1.8	0.0028	0.07
6210	3	Cypress	2,531.29	98,562.00	24.3	0.0380	0.90
6300	4	Wetland Forested Mixed	5,841.34	219,392.66	54.2	0.0846	2.01
6410	15	Freshwater Marshes	6,397.80	164,389.65	40.6	0.0634	1.51
6430	1	Wet Prairies	151.49	1,622.34	0.4	0.0006	0.01
6440	13	Emergent Aquatic Vegetation	5,828.58	81,724.04	20.2	0.0315	0.75
6530	1	Intermittent Ponds	249.12	3,438.07	0.8	0.0013	0.03
7400	1	Disturbed Land	1,451.05	136,146.96	33.6	0.0525	1.25
8100	1	Transportation	2,300.60	35,347.71	8.7	0.0136	0.32
8300	1	Utilities	672.25	25,076.64	6.2	0.0097	0.23
		TOTAL	200,787.52	10,917,396.24	2,696.6	4.2121	100.00

Figure 4.1. Principal Land Uses in the Flint Creek Watershed



Population

According to the U.S Census Bureau, the population density in and around WBID 1522A in the year 2000 ranged between 289 and 444 people per square mile (10 person/mi² is the minimum used by the Census Bureau) (U.S. Census Bureau, 2004) **(Figure 4.2)**. The Bureau reports that, in the area of WBID 1522A, the number of people per household ranged between 2.62 and 2.85 **(Figure 4.3)**. Based on these statistics, the density of homes was between 101 and 169 homes per square mile. According to the 1999 land use summary, approximately 27 percent of the area in WBID 1522A was in the residential category.

Figure 4.2. Population Density in the Flint Creek Area,
Based on the 2000 U.S. Census

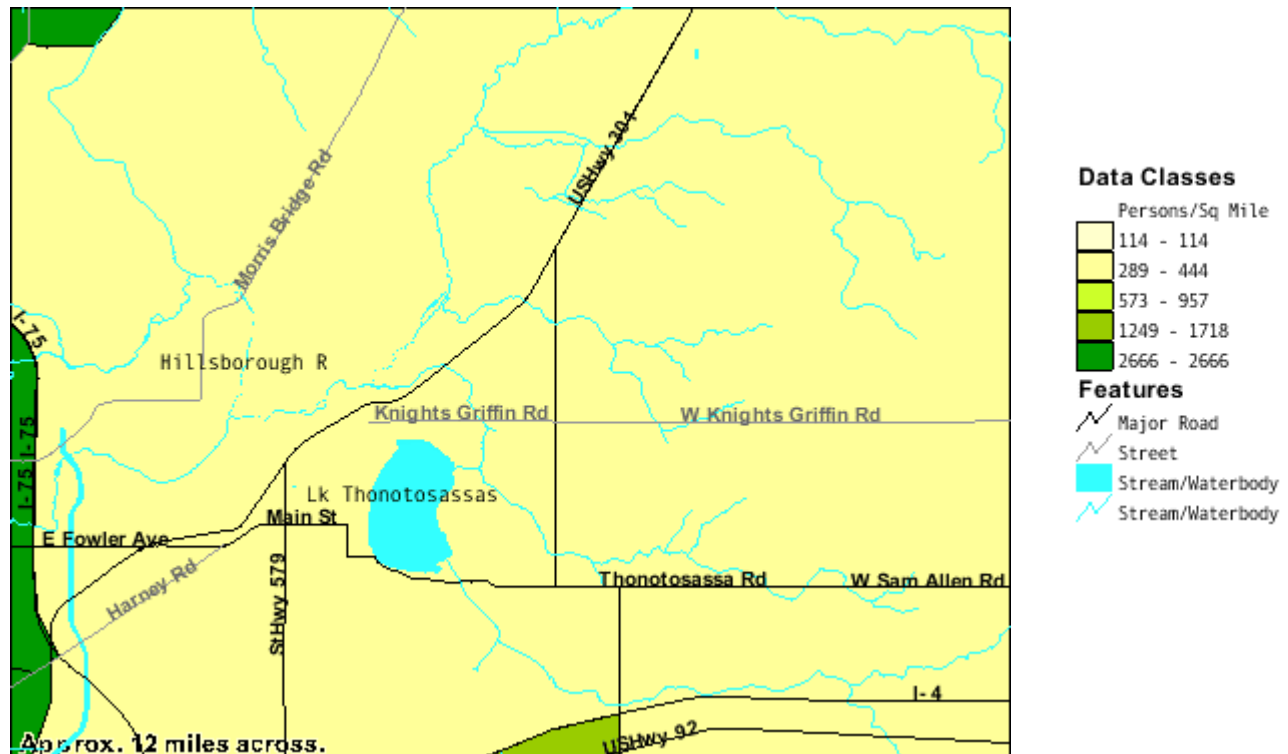
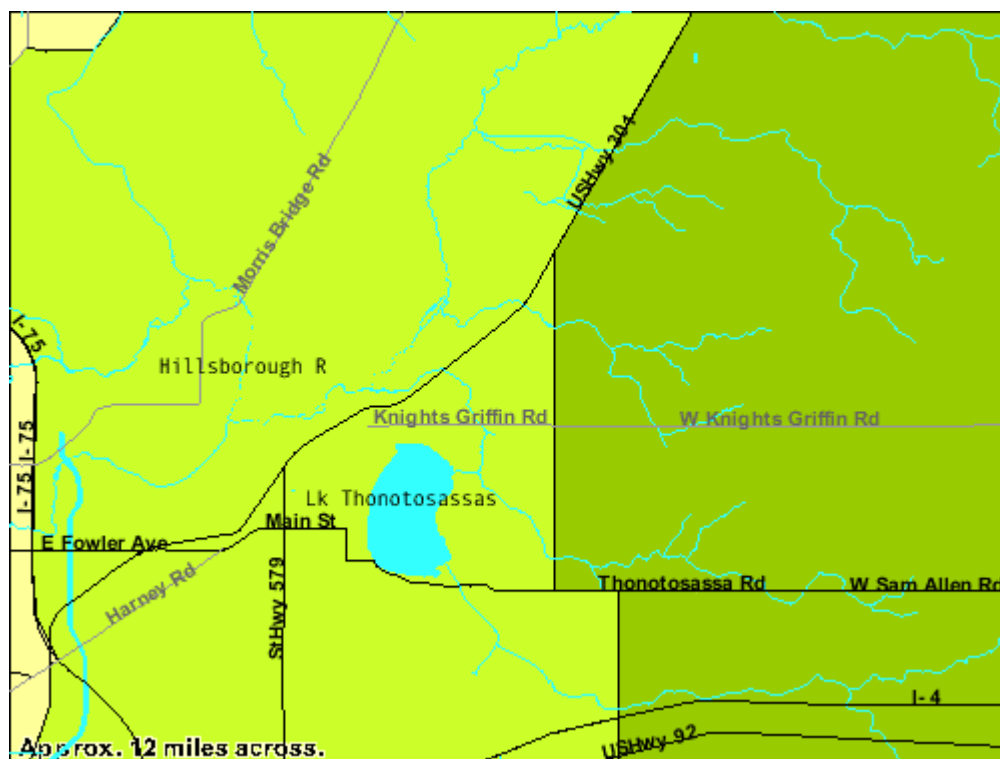


Figure 4.3. Persons Per Household in the Flint Creek Area,
Based on the 2000 U.S. Census



Data Classes

Persons	
2.07 - 2.07	
2.38 - 2.38	
2.62 - 2.73	
2.77 - 2.85	
3.09 - 3.09	

Features

Major Road	
Street	
Stream/Waterbody	
Stream/Waterbody	

Septic Tanks

The Florida Department of Health (FDOH) reports that as of fiscal year 2002, there were potentially as many as 100,483 permitted septic tanks in Hillsborough County (Florida Department of Health Web site, 2004) (**Table 4.2**). The word potential is used, since the total starts with the 1970 census (51,500) and does not incorporate reductions in septic tank numbers as a result of connections to centralized sewer systems. From 1993 – 2002, 9,140 permits for repairs were issued (Florida Department of Health Web site, 2004) (**Table 4.2**).

Table 4.2. Hillsborough County Septic Tank Installation and Repair Statistics

Years	Septic Tanks Installed	Years	Septic Tanks Repaired
1970 (Census)	51,500	1991–92	0
1971	1,391	1992–93	
1972	1,362	1993–94	986
1973	549	1994–95	994
1974	2,861	1995–96	1,009
1975	2,343	1996–97	1,129
1976	3,991	1997–98	1,110
1977	1,171	1998–99	1,138
1978	4,268	1999–00	934
1979	1,909	2000–01	927
1980	2,331	2001–02	913
1981	1,928		
1982	1,198		
1983	1,640		
1984	1,840		
1985	2,326		
1986	1,515		
1987	1,550		
1988	1,546		
1989	1,373		
1990	947		
1991 (1/2)			
1991–92	866		
1992–93	884		
1993–94	898		
1994–95	925		
1995–96	894		
1996–97	1,012		
1997–98	918		
1998–99	1,217		
1999–00	1,203		
2000–01	1,123		

Years	Septic Tanks Installed	Years	Septic Tanks Repaired
2001-02	1,004		
CUMULATIVE	100,483		

WBID 1522A comprises 4.2 square miles. Based on the earlier estimated housing density of 101 to 169 homes per square mile, this would yield an estimated 424 to 710 septic tanks in WBID 1522A (assuming that centralized sewer collection systems are not present in the WBID).

As a first attempt at estimating the number of failing septic tanks in the WBID, the number of septic tank repairs was divided by the number of permitted septic tanks (**Table 4.2**) to obtain a failure rate of 9.1 percent. An earlier comment noted that the sum of permitted septic tanks does not necessary reflect the current number. Similarly, the previous calculation represented two different time periods and also assumed that repairs were equally distributed across the county (certain areas may have much higher failure rates due to the age of the system, soil types, or ground water table). Applying the 9.1 percent failure rate would result in an estimate of between 38 and 65 failing septic systems in the WBID. Using this number, and assuming water use of 70 gallons per day per person (U.S. Environmental Protection Agency, 2001), 2.75 persons per home, and a fecal coliform concentration of 1×10^6 colonies/100 mL, a loading of 2.77 to 4.74×10^{11} colonies/day is derived.

Livestock

Another potential nonpoint source of coliforms includes livestock and other agricultural animals. **Table 4.3a** summarizes cattle populations in Hillsborough County from 1993 to 2002, and **Table 4.3b** summarizes populations of other agricultural animals in the county in 1992 and 1997. Hillsborough County ranked as the ninth highest county in the state in terms of the number of cattle and calves and beef cows. Over 18 percent of WBID 1522A is specifically categorized as cropland and pastureland under the Level 3 land use system.

Table 4.3a. Summary of Cattle Populations in Hillsborough County, 1993 – 2002

Year	Number of Milk Cows	Number of Cattle and Calves	Number of Beef Cows
1993	7,500	72,000	36,000
1994	7,200	75,000	35,000
1995	7,400	74,000	35,000
1996	6,500	76,000	37,000
1997	6,100	74,000	35,000
1998	4,400	68,000	35,000
1999	5,000	67,000	34,000
2000	4,500	68,000	36,000
2001	4,500	66,000	34,000
2002	4,500	66,000	32,000

Year	Number of Milk Cows	Number of Cattle and Calves	Number of Beef Cows
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Source: Florida Agricultural Fast Facts, 2003.

Table 4.3b. Summary of Agricultural Animal Populations
(Excluding Cattle) in Hillsborough County, 1992
and 1997

	Year	
	1992	1997
Hogs and Pigs	5,143	3,567
Poultry		
Layers and pullets 13 weeks and older	2,014,553	1,409,342
Layers and pullets 20 weeks and older	1,898,300	1,009,154
Sheep and Lambs	432	285
Horses		2,754
Milk Goats		47
Goats, except Angora and Milk		970
Ducks		163
Geese		159
Pheasants		47
Other Poultry		344
Mules, Burros, and Donkeys		94
Rabbits		1,121

Source: U.S. Department of Agriculture, 1997.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

A simple approach was used for this TMDL. The TMDL was based on analyzing observations that exceeded the fecal or total criterion, and for each exceedance, the percent reduction necessary to meet the respective criterion was calculated. The individual percent reductions were ranked, and the median became the TMDL target.

Although some flow information was available for this WBID (U.S. Geological Survey [USGS] Gage 02303300), the flow record was limited to the period from January 1, 1990, to September 30, 1991. Extending the flow record using another gauging station with a long period of record was considered inappropriate, because a large portion of the drainage area for the Flint Creek gage is Lake Thonotosassa and drainage to the lake. Hydrologically, the lake could significantly influence runoff events, and the resulting stream flow would not be represented by the use of another stream gauging station and the application of a drainage ratio to adjust flows.

5.1.1 Data Used in the Determination of the TMDLs

There are four sampling stations in WBID 1522A that have historical observations (**Figure 5.1**). The primary data collector is the Hillsborough County Environmental Protection Commission, which has maintained a routine sampling site at the U.S. 301 bridge crossing of Flint Creek (STORET ID: 21FLHILL 148, or 21FLHILL24030007). The site was sampled on a monthly basis from January 22, 1991, through December 10, 2002. **Table 5.1** provides a brief statistical overview of the observed data at these sites. **Appendix B** contains the historical observations and cumulative frequency plots from the sites.

Figure 5.1. Historical Monitoring Sites in Flint Creek, WBID 1522A

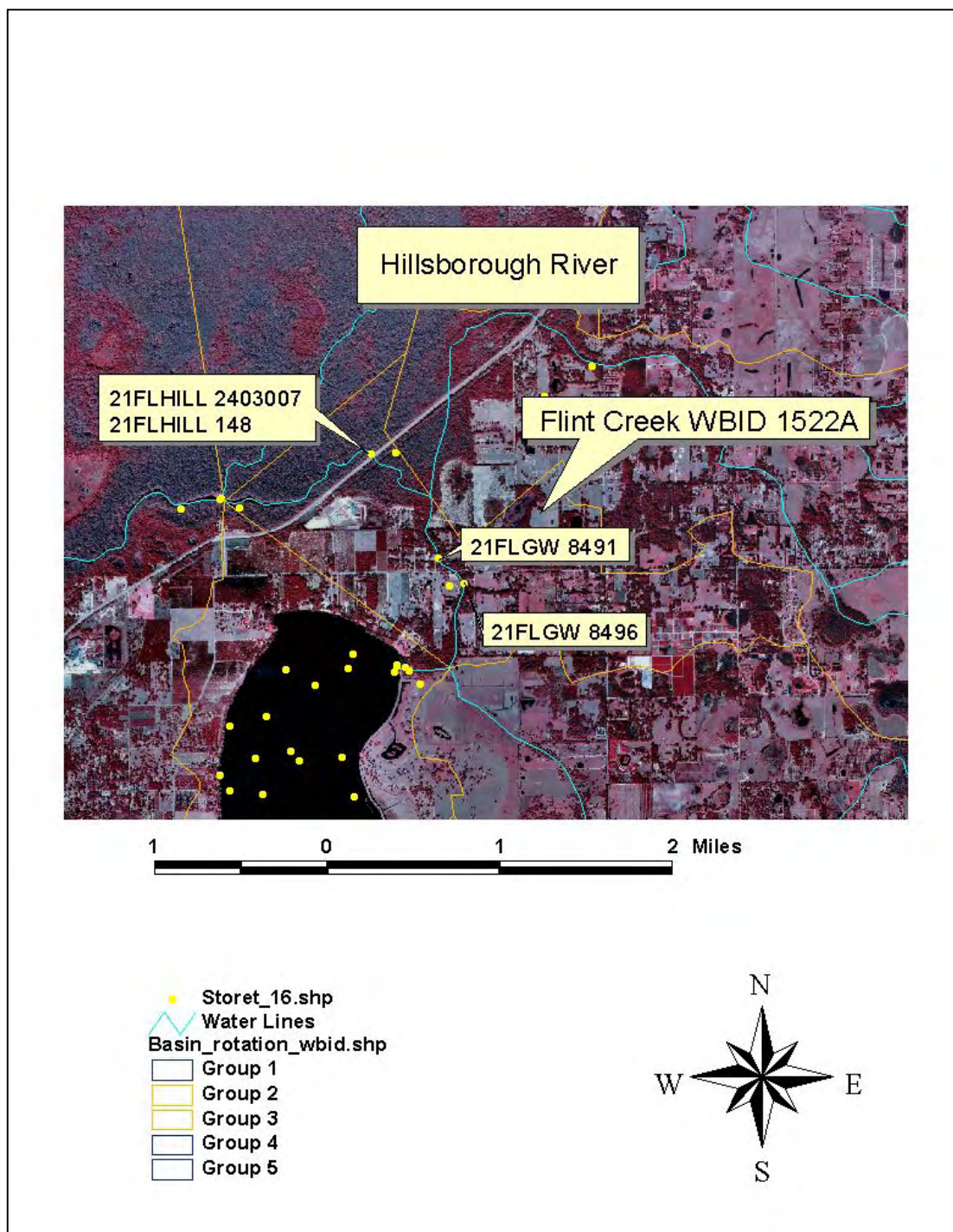


Table 5.1. Statistical Summary of Fecal and Total Coliform Data for Flint Creek, WBID 1522A

Statistics	Fecal Coliforms	Total Coliforms
No. of cases	155	143
Minimum	20	200
Maximum	30000	30000
Median	260	1600
Mean	655.3806452	3069.230769
Standard Deviation	2463.524648	4337.183333
N 1 of 10	40	500
N 2 of 10	100	700
N 3 of 10	120	940
N 4 of 10	200	1200
N 5 of 10	260	1600
N 6 of 10	305	2000
N 7 of 10	400	2600
N 8 of 10	700	3400
N 9 of 10	1040	9220

5.1.2 TMDL Development Process

As described in **Section 5.1**, tables of observations that exceeded the respective fecal or total coliform criterion were constructed, and the percent reduction necessary for each observation to achieve the appropriate criterion was calculated using the expression:

$$\frac{[(\text{observed concentration}) - (\text{allowable concentration})] \times 100}{(\text{observed concentration})}$$

Tables 5.2 and 5.3 summarize the individual calculations and the overall average reductions in fecal and total coliforms necessary to meet the respective criterion.

Table 5.2. Calculation of Percent Reduction in Fecal Coliforms Necessary To Meet Water Quality Standard of 400 Colonies/100 mL in Flint Creek, WBID 1522A

Date	Station	Fecal Coliform	% Reduction
1/22/1991	21FLHILL24030007	1800	77.78
2/25/1991	21FLHILL24030007	1100	63.64
5/21/1991	21FLHILL24030007	30000	98.67
6/25/1991	21FLHILL24030007	800	50.00
7/30/1991	21FLHILL24030007	2400	83.33

Date	Station	Fecal Coliform	% Reduction
9/24/1991	21FLHILL24030007	1000	60.00
10/22/1991	21FLHILL24030007	800	50.00
11/19/1991	21FLHILL24030007	2500	84.00
12/10/1991	21FLHILL24030007	1100	63.64
1/28/1992	21FLHILL24030007	1300	69.23
2/25/1992	21FLHILL24030007	2300	82.61
2/25/1992	21FLHILL24030007	2300	82.61
4/21/1992	21FLHILL24030007	1900	78.95
5/26/1992	21FLHILL24030007	1300	69.23
6/23/1992	21FLHILL24030007	1400	71.43
10/27/1992	21FLHILL24030007	500	20.00
10/27/1992	21FLHILL24030007	500	20.00
9/14/1993	21FLHILL24030007	620	35.48
9/14/1993	21FLHILL24030007	620	35.48
4/26/1994	21FLHILL24030007	900	55.56
8/23/1994	21FLHILL24030007	720	44.44
9/27/1994	21FLHILL24030007	540	25.93
12/13/1994	21FLHILL24030007	700	42.86
7/25/1995	21FLHILL24030007	460	13.04
9/26/1995	21FLHILL24030007	800	50.00
10/24/1995	21FLHILL24030007	720	44.44
10/24/1995	21FLHILL24030007	720	44.44
11/28/1995	21FLHILL24030007	780	48.72
7/16/1996	21FLHILL24030007	580	31.03
9/24/1996	21FLHILL24030007	480	16.67
12/10/1996	21FLHILL24030007	960	58.33
1/21/1997	21FLHILL24030007	940	57.45
4/15/1997	21FLHILL24030007	1000	60.00
7/22/1997	21FLHILL24030007	840	52.38
2/17/1998	21FLHILL24030007	4760	91.60
7/21/1998	21FLHILL24030007	4000	90.00
6/15/1999	21FLHILL148	660	39.39
8/17/1999	21FLHILL148	660	39.39
9/22/1999	21FLHILL148	500	20.00
10/12/1999	21FLHILL148	620	35.48
12/14/1999	21FLHILL148	520	23.08
2/15/2000	21FLHILL148	560	28.57
3/20/2001	21FLHILL148	700	42.86
1/15/2002	21FLHILL148	960	58.33
7/23/2002	21FLHILL148	1040	61.54

Date	Station	Fecal Coliform	% Reduction
12/10/2002	21FLHILL148	1920	79.17
MEDIAN % REDUCTION =			51.2

Table 5.3. Calculation of Percent Reduction in Total Coliforms Necessary To Meet Water Quality Standard of 2,400 colonies/100 mL. Observed Data for Calculating Exceedances to the State Criterion for Total Coliforms for Flint Creek, WBID1522A

Date	Station	Total Coliform	% Reduction
6/23/1992 0:00	21FLHILL24030007	2500	4.00
6/15/2000 0:00	21FLGW 8491	2500	4.00
2/25/1992 0:00	21FLHILL24030007	2600	7.69
2/25/1992 0:00	21FLHILL24030007	2600	7.69
9/14/1993 0:00	21FLHILL24030007	2600	7.69
9/14/1993 0:00	21FLHILL24030007	2600	7.69
9/27/1994 0:00	21FLHILL24030007	2600	7.69
6/15/1993 0:00	21FLHILL24030007	2700	11.11
6/15/1993 0:00	21FLHILL24030007	2700	11.11
11/28/1995 0:00	21FLHILL24030007	2700	11.11
2/21/1995 0:00	21FLHILL24030007	2800	14.29
12/10/1996 0:00	21FLHILL24030007	2800	14.29
4/21/1992 0:00	21FLHILL24030007	2900	17.24
6/27/1995 0:00	21FLHILL24030007	3100	22.58
7/30/1991 0:00	21FLHILL24030007	3200	25.00
5/26/1992 0:00	21FLHILL24030007	3200	25.00
8/23/1994 0:00	21FLHILL24030007	3300	27.27
1/18/2000 0:00	21FLHILL148	3400	29.41
3/14/2000 0:00	21FLHILL148	3400	29.41
10/16/2001 0:00	21FLHILL148	3400	29.41
7/25/1995 0:00	21FLHILL24030007	3600	33.33
4/15/1997 0:00	21FLHILL24030007	3800	36.84
4/17/2001 0:00	21FLHILL148	3800	36.84
9/22/1999 0:00	21FLHILL148	4100	41.46
10/12/1999 0:00	21FLHILL148	4200	42.86
11/19/1991 0:00	21FLHILL24030007	4300	44.19
8/17/1999 0:00	21FLHILL148	4400	45.45
11/13/2001 0:00	21FLHILL148	5100	52.94
9/26/1995 0:00	21FLHILL24030007	5200	53.85

Date	Station	Total Coliform	% Reduction
12/11/2001 0:00	21FLHILL148	7500	68.00
2/15/2000 0:00	21FLHILL148	8800	72.73
6/15/2000 0:00	21FLGW 8496	9000	73.33
7/18/2000 0:00	21FLHILL148	9200	73.91
10/10/2000 0:00	21FLHILL148	9300	74.19
9/19/2000 0:00	21FLHILL148	9600	75.00
8/15/2000 0:00	21FLHILL148	10200	76.47
12/12/2000 0:00	21FLHILL148	10500	77.14
6/19/2001 0:00	21FLHILL148	10900	77.98
9/18/2001 0:00	21FLHILL148	11200	78.57
2/17/1998 0:00	21FLHILL24030007	11500	79.13
8/21/2001 0:00	21FLHILL148	12200	80.33
7/24/2001 0:00	21FLHILL148	13300	81.95
3/20/2001 0:00	21FLHILL148	15600	84.62
5/15/2001 0:00	21FLHILL148	15700	84.71
11/14/2000 0:00	21FLHILL148	18400	86.96
7/21/1998 0:00	21FLHILL24030007	20000	88.00
5/21/1991 0:00	21FLHILL24030007	30000	92.00
MEDIAN % REDUCTION =			41.5

5.2.3 Critical Conditions/Seasonality

In **Chapter 2**, summary statistics were provided that considered temporal patterns in exceedances of fecal and total coliforms in Flint Creek. Exceedances of the fecal and total coliform criteria occurred in every month. Although the summer quarter (July – September) had the largest exceedance rate for both fecal and total coliforms and the mean monthly rainfall amount was the highest in this quarter, linear regressions between exceedance rates by season versus rainfall were not significant. Consequently, the method of determining the TMDL considered all the exceedances, independent of month or season, and calculated a median percent reduction necessary to meet the respective water quality standard.

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (Waste Load Allocations, or WLAs), nonpoint source loads (Load Allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\text{TMDL} \cong \sum \text{WLAs}_{\text{wastewater}} + \sum \text{WLAs}_{\text{NPDES Stormwater}} + \sum \text{LAs} + \text{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of BMPs.

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. TMDLs for Flint Creek WBID 1522A are expressed in terms of percent reductions and represent the maximum coliform the river can assimilate and maintain the water quality criteria for fecal and total coliform (**Table 6.1**).

Table 6.1. Fecal and Total Coliform TMDLs for Flint Creek,
WBID 1522A

Parameter	TMDL (Colonies/ 100 mL)	WLA		LA (Percent Reduction)†	MOS
		Wastewater (Colonies/day)	NPDES Stormwater (percent)		
Fecal Coliform	400 #/100 mL	NA	51.2%	51.2 %	Implicit
Total Coliform	2400 #/100 mL	NA	41.5%	41.5 %	Implicit

NA – Not applicable.

6.2 Load Allocation (LA)

A fecal coliform reduction of 51.2 percent and a total coliform reduction of 41.5 percent are needed from nonpoint sources. It should be noted that the LA includes loading from stormwater discharges that are not part of the NPDES Stormwater Program.

6.3 Wasteload Allocation (WLA)

There are no point sources with surface discharges to this WBID. Consequently, there are no reductions that would be applied to domestic and/or industrial point sources in the WBID. Any future discharge permits issued within Flint Creek WBID 1522A will be required to meet state Class III criteria for fecal and total coliforms, as well as the TMDL value. Any future allocations would require a reduction in nonpoint sources such that these values are not exceeded.

6.3.2 NPDES Stormwater Discharges

Flint Creek is part of Hillsborough County and is covered by the Hillsborough County Public Works and the Florida Department of Transportation District 7 Phase I MS4 permit. The WLA for stormwater discharges with a MS4 permit is a 51.2 percent reduction in current fecal coliform and a 41.5 percent reduction in current total coliform loading from the MS4. It should be noted that any MS4 permittee will only be responsible for reducing the loads associated with stormwater outfalls which it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety (MOS)

Consistent with the recommendations of the Allocation Technical Advisory Committee (Florida Department of Environmental Protection, February 2001), an implicit margin of safety (MOS) was used in the development of this TMDL. A MOS was included in the TMDL by not allowing

any exceedances of the state criterion, even though intermittent natural exceedances of the criterion would be expected and would be taken into account when determining impairment. Finally, the TMDL calculated for fecal coliforms was based on meeting the water quality criterion of 400 colonies/100 mL without any exceedances, while the actual criterion allows for a 10 percent exceedance over that level.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the Basin Management Action Plan (BMAP) for the Tampa Bay Tributaries. This document will be developed over the next year in cooperation with local stakeholders and will attempt to reach consensus on more detailed allocations and on how load reductions will be accomplished. The BMAP will include the following:

- Appropriate allocations among the affected parties,
- A description of the load reduction activities to be undertaken,
- Timetables for project implementation and completion,
- Funding mechanisms that may be utilized,
- Any applicable signed agreement,
- Local ordinances defining actions to be taken or prohibited,
- Local water quality standards, permits, or load limitation agreements, and
- Monitoring and follow-up measures.

References

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, Florida Statutes (F.S.), was established as a technology-based program that relies on the implementation of best management practices (BMPs) that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, Florida Administrative Code (F.A.C.).

The rule requires the state's water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a Total Maximum Daily Load (TMDL). To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG has been developed for Newnans Lake at the time this TMDL report was developed.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal Nonpoint Source Discharge Elimination System (NPDES) stormwater permitting program to designate certain stormwater discharges as "point sources" of pollution. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as municipal separate storm sewer systems (MS4s). However, because the master drainage systems of most local governments in Florida are interconnected, the U.S. Environmental Protection Agency (EPA) has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the 15 counties meeting the population criteria.

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase 2 of the NPDES Program will expand the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 10,000 people. The revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution, such as domestic and industrial wastewater discharges. The Florida Department of Environmental Protection recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a re-opener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

Appendix B: Fecal and Total Coliform Observations for Flint Creek, WBID 1522A, January 1991 – December 2001

Table B.1. Fecal Coliform Observations in Flint Creek, WBID 1522A, January 1991 – December 2001

Date	Station	Time	Depth	Fecal Coliform	Remark code
1/22/1991	21FLHILL24030007	1300	1.00	1800	
2/25/1991	21FLHILL24030007	1315	1.00	1100	
3/26/1991	21FLHILL24030007	1255	1.00	200	
4/23/1991	21FLHILL24030007	1240	1.00	400	
5/21/1991	21FLHILL24030007	1240	1.00	30000	L
6/25/1991	21FLHILL24030007	1330	1.00	800	
7/30/1991	21FLHILL24030007	1230	1.00	2400	
8/27/1991	21FLHILL24030007	1345	1.00	400	
9/24/1991	21FLHILL24030007	1225	1.00	1000	
10/22/1991	21FLHILL24030007	1313	1.00	800	
11/19/1991	21FLHILL24030007	1237	1.00	2500	
12/10/1991	21FLHILL24030007	1330	1.00	1100	
1/28/1992	21FLHILL24030007	1225	1.00	1300	
2/25/1992	21FLHILL24030007	1330	3.25	2300	
2/25/1992	21FLHILL24030007	1330	3.30	2300	
3/24/1992	21FLHILL24030007	1245	3.00	400	
4/21/1992	21FLHILL24030007	1305	3.00	1900	
5/26/1992	21FLHILL24030007	1315	2.50	1300	
6/23/1992	21FLHILL24030007	1245	2.50	1400	J
7/28/1992	21FLHILL24030007	1245	3.00	100	K
8/25/1992	21FLHILL24030007	1250	3.75	300	
8/25/1992	21FLHILL24030007	1250	3.80	300	
9/22/1992	21FLHILL24030007	1305	3.25	200	
9/22/1992	21FLHILL24030007	1305	3.30	200	
10/27/1992	21FLHILL24030007	1325	2.75	500	
10/27/1992	21FLHILL24030007	1325	2.80	500	
11/17/1992	21FLHILL24030007	1305	3.50	100	
12/15/1992	21FLHILL24030007	1345	3.30	400	
12/15/1992	21FLHILL24030007	1345	3.25	400	
1/19/1993	21FLHILL24030007	1330	3.25	100	
1/19/1993	21FLHILL24030007	1330	3.30	100	
2/16/1993	21FLHILL24030007	1350	1.00	100	
3/16/1993	21FLHILL24030007	1355	1.00	200	

Date	Station	Time	Depth	Fecal Coliform	Remark code
4/20/1993	21FLHILL24030007	1255	1.00	100	K
5/18/1993	21FLHILL24030007	1345	1.00	100	
6/15/1993	21FLHILL24030007	1347	2.25	100	K
6/15/1993	21FLHILL24030007	1347	2.30	100	K
7/20/1993	21FLHILL24030007	1330	2.80	300	
8/17/1993	21FLHILL24030007	1340	1.00	80	
8/17/1993	21FLHILL24030007	1340	2.50	80	
9/14/1993	21FLHILL24030007	1317	1.00	620	
9/14/1993	21FLHILL24030007	1317	3.25	620	
10/19/1993	21FLHILL24030007	1340	1.00	200	
11/16/1993	21FLHILL24030007	1320	1.00	280	
12/14/1993	21FLHILL24030007	1340	1.00	280	
1/25/1994	21FLHILL24030007	1325	1.00	240	
2/22/1994	21FLHILL24030007	1313	1.00	220	
3/22/1994	21FLHILL24030007	1329	1.00	340	
4/26/1994	21FLHILL24030007	1328	1.00	900	
5/24/1994	21FLHILL24030007	1335	1.00	20	
6/21/1994	21FLHILL24030007	1425	1.00	40	
7/26/1994	21FLHILL24030007	1355	1.00	280	
8/23/1994	21FLHILL24030007	1403	1.00	720	
9/27/1994	21FLHILL24030007	1400	1.00	540	
10/25/1994	21FLHILL24030007	1425	1.00	140	
11/29/1994	21FLHILL24030007	1345	1.00	220	
12/13/1994	21FLHILL24030007	1340	1.00	700	
1/24/1995	21FLHILL24030007	1405	1.00	300	
2/21/1995	21FLHILL24030007	1410	1.00	380	
3/21/1995	21FLHILL24030007	1350	1.00	100	
4/25/1995	21FLHILL24030007	1400	1.00	100	
5/23/1995	21FLHILL24030007	1425	1.00	260	
6/27/1995	21FLHILL24030007	1420	1.00	280	
7/25/1995	21FLHILL24030007	1410	1.00	460	
8/22/1995	21FLHILL24030007	1350	1.00	160	
9/26/1995	21FLHILL24030007	1400	1.00	800	
10/24/1995	21FLHILL24030007	1350	3.25	720	
10/24/1995	21FLHILL24030007	1350	3.30	720	
11/28/1995	21FLHILL24030007	1415	3.50	780	
12/12/1995	21FLHILL24030007	1336	3.50	220	
1/23/1996	21FLHILL24030007	1330	3.30	300	
2/20/1996	21FLHILL24030007	1410	3.00	240	
3/19/1996	21FLHILL24030007	1340	2.75	180	

Date	Station	Time	Depth	Fecal Coliform	Remark code
3/19/1996	21FLHILL24030007	1340	2.80	180	
4/16/1996	21FLHILL24030007	1335	3.00	60	
5/14/1996	21FLHILL24030007	1405	2.50	60	
6/18/1996	21FLHILL24030007	1400	3.25	260	
6/18/1996	21FLHILL24030007	1400	3.30	260	
7/16/1996	21FLHILL24030007	1353	3.00	580	
8/20/1996	21FLHILL24030007	1410	3.00	180	
9/24/1996	21FLHILL24030007	1340	2.80	480	
10/15/1996	21FLHILL24030007	1350	3.00	320	
11/19/1996	21FLHILL24030007	1340	3.30	400	
12/10/1996	21FLHILL24030007	1355	2.80	960	
1/21/1997	21FLHILL24030007	1343	2.30	940	
2/18/1997	21FLHILL24030007	1400	2.80	360	
3/18/1997	21FLHILL24030007	1350	2.00	20	
4/15/1997	21FLHILL24030007	1315	2.00	1000	
5/20/1997	21FLHILL24030007	1350	2.30	40	
6/17/1997	21FLHILL24030007	1445	2.50	40	
7/22/1997	21FLHILL24030007	1430	3.00	840	
8/19/1997	21FLHILL24030007	1345	3.80	100	
9/16/1997	21FLHILL24030007	1320	3.30	200	
10/14/1997	21FLHILL24030007	1410	2.80	320	
11/18/1997	21FLHILL24030007	1425	4.00	120	
12/9/1997	21FLHILL24030007	1335	3.80	180	
1/20/1998	21FLHILL24030007	1310	3.50	280	
2/17/1998	21FLHILL24030007	1400	5.00	4760	
3/17/1998	21FLHILL24030007	1330	3.50	100	
4/21/1998	21FLHILL24030007	1428	3.00	200	
5/19/1998	21FLHILL24030007	1432	2.50	20	K
6/16/1998	21FLHILL24030007	1310	2.30	60	
7/21/1998	21FLHILL24030007	1332	3.30	4000	L
8/25/1998	21FLHILL24030007	1334	3.80	80	
9/15/1998	21FLHILL24030007	1441	3.80	220	
10/20/1998	21FLHILL24030007	1332	3.50	220	
11/17/1998	21FLHILL24030007	1345	3.50	100	
12/8/1998	21FLHILL24030007	1320	2.50	120	
1/19/1999	21FLHILL148	1340	2.50	260	
2/16/1999	21FLHILL148	1346	3.30	20	
3/16/1999	21FLHILL148	1413	3.00	20	U
4/20/1999	21FLHILL148	1335	3.00	60	
5/18/1999	21FLHILL148	1335	3.00	40	

Date	Station	Time	Depth	Fecal Coliform	Remark code
6/15/1999	21FLHILL148	1332	2.50	660	
7/20/1999	21FLHILL148	1345	3.30	280	
8/17/1999	21FLHILL148	1534	3.50	660	
9/22/1999	21FLHILL148	1445	3.00	500	
10/12/1999	21FLHILL148	1420	3.50	620	
11/16/1999	21FLHILL148	1342	3.30	120	
12/14/1999	21FLHILL148	1420	3.30	520	
1/18/2000	21FLHILL148	1350	2.50	140	
2/15/2000	21FLHILL148	1330	3.00	560	
3/14/2000	21FLHILL148	1340	3.00	40	
6/15/2000	21FLGW 8491	1115	0.05	310	
6/15/2000	21FLGW 8496	1215	0.10	84	
7/18/2000	21FLHILL148	1435	2.80	20	U
8/15/2000	21FLHILL148	1445	3.00	220	
9/19/2000	21FLHILL148	1440	3.50	180	
10/10/2000	21FLHILL148	1410	.	180	
11/14/2000	21FLHILL148	1345	.	60	
12/12/2000	21FLHILL148	1337	.	20	
1/16/2001	21FLHILL148	1325	.	20	U
2/20/2001	21FLHILL148	1332	.	20	U
3/20/2001	21FLHILL148	1303	.	700	
4/17/2001	21FLHILL148	1422	.	20	
5/15/2001	21FLHILL148	1335	.	80	
6/19/2001	21FLHILL148	1435	.	20	
7/24/2001	21FLHILL148	1349	.	300	
8/21/2001	21FLHILL148	1400	.	140	
9/18/2001	21FLHILL148	1405	.	20	U
10/16/2001	21FLHILL148	1347	.	100	
11/13/2001	21FLHILL148	1411	.	180	
12/11/2001	21FLHILL148	1357	.	380	
1/15/2002	21FLHILL148	1445	2.95	960	
2/19/2002	21FLHILL148	1428	1.97	340	
3/19/2002	21FLHILL148	1506	2.95	180	
4/16/2002	21FLHILL148	1405	2.30	320	
5/14/2002	21FLHILL148	1331	2.62	90	
6/18/2002	21FLHILL148	1352	2.62	360	
7/23/2002	21FLHILL148	1442	2.95	1040	
8/20/2002	21FLHILL148	1351	3.61	60	
9/17/2002	21FLHILL148	1428	2.95	170	
10/15/2002	21FLHILL148	1345	3.61	180	

Date	Station	Time	Depth	Fecal Coliform	Remark code
11/19/2002	21FLHILL148	1327	3.61	230	
12/10/2002	21FLHILL148	1413	3.28	1920	

Remark Codes: J – Estimated value

K – Actual value is known to be less than value given

L – Actual value is known to be greater than value given

U – Material analyzed for but not detected, value reported is minimum
detection limit

Table B2. Total Coliform Observations in Flint Creek, WBID
1522A, January 1991 – December 2001

Date	Station	Time	Depth	Total Coliform	Remark Code
1/22/1991 0:00	21FLHILL24030007	1300	1	1800	
2/25/1991 0:00	21FLHILL24030007	1315	1	1100	
3/26/1991 0:00	21FLHILL24030007	1255	1	600	
4/23/1991 0:00	21FLHILL24030007	1240	1	600	
5/21/1991 0:00	21FLHILL24030007	1240	1	30000	L
6/25/1991 0:00	21FLHILL24030007	1330	1	800	
7/30/1991 0:00	21FLHILL24030007	1230	1	3200	
8/27/1991 0:00	21FLHILL24030007	1345	1	900	
9/24/1991 0:00	21FLHILL24030007	1225	1	2100	
10/22/1991 0:00	21FLHILL24030007	1313	1	2300	
11/19/1991 0:00	21FLHILL24030007	1237	1	4300	
12/10/1991 0:00	21FLHILL24030007	1330	1	1100	
1/28/1992 0:00	21FLHILL24030007	1225	1	1900	
2/25/1992 0:00	21FLHILL24030007	1330	3.3	2600	
2/25/1992 0:00	21FLHILL24030007	1330	3.25	2600	
3/24/1992 0:00	21FLHILL24030007	1245	3	1200	
4/21/1992 0:00	21FLHILL24030007	1305	3	2900	
5/26/1992 0:00	21FLHILL24030007	1315	2.5	3200	
6/23/1992 0:00	21FLHILL24030007	1245	2.5	2500	
7/28/1992 0:00	21FLHILL24030007	1245	3	400	
8/25/1992 0:00	21FLHILL24030007	1250	3.8	700	
8/25/1992 0:00	21FLHILL24030007	1250	3.75	700	
9/22/1992 0:00	21FLHILL24030007	1305	3.3	1700	
9/22/1992 0:00	21FLHILL24030007	1305	3.25	1700	
10/27/1992 0:00	21FLHILL24030007	1325	2.8	2200	
10/27/1992 0:00	21FLHILL24030007	1325	2.75	2200	
11/17/1992 0:00	21FLHILL24030007	1305	3.5	1600	
12/15/1992 0:00	21FLHILL24030007	1345	3.3	600	
12/15/1992 0:00	21FLHILL24030007	1345	3.25	600	
1/19/1993 0:00	21FLHILL24030007	1330	3.3	600	
1/19/1993 0:00	21FLHILL24030007	1330	3.25	600	
2/16/1993 0:00	21FLHILL24030007	1350	1	500	
3/16/1993 0:00	21FLHILL24030007	1355	1	2000	
4/20/1993 0:00	21FLHILL24030007	1255	1	1200	
5/18/1993 0:00	21FLHILL24030007	1345	1	1000	
6/15/1993 0:00	21FLHILL24030007	1347	2.25	2700	
6/15/1993 0:00	21FLHILL24030007	1347	2.3	2700	

Date	Station	Time	Depth	Total Coliform	Remark Code
7/20/1993 0:00	21FLHILL24030007	1330	2.8	1900	
8/17/1993 0:00	21FLHILL24030007	1340	1	1100	
8/17/1993 0:00	21FLHILL24030007	1340	2.5	1100	
9/14/1993 0:00	21FLHILL24030007	1317	1	2600	
9/14/1993 0:00	21FLHILL24030007	1317	3.25	2600	
10/19/1993 0:00	21FLHILL24030007	1340	1	1300	
11/16/1993 0:00	21FLHILL24030007	1320	1	900	
12/14/1993 0:00	21FLHILL24030007	1340	1	1100	
1/25/1994 0:00	21FLHILL24030007	1325	1	300	
2/22/1994 0:00	21FLHILL24030007	1313	1	1500	
3/22/1994 0:00	21FLHILL24030007	1329	1	1400	
4/26/1994 0:00	21FLHILL24030007	1328	1	1400	
5/24/1994 0:00	21FLHILL24030007	1335	1	500	
6/21/1994 0:00	21FLHILL24030007	1425	1	1800	
7/26/1994 0:00	21FLHILL24030007	1355	1	1400	
8/23/1994 0:00	21FLHILL24030007	1403	1	3300	
9/27/1994 0:00	21FLHILL24030007	1400	1	2600	
10/25/1994 0:00	21FLHILL24030007	1425	1	1100	
11/29/1994 0:00	21FLHILL24030007	1345	1	900	
12/13/1994 0:00	21FLHILL24030007	1340	1	1800	
1/24/1995 0:00	21FLHILL24030007	1405	1	1100	
2/21/1995 0:00	21FLHILL24030007	1410	1	2800	
3/21/1995 0:00	21FLHILL24030007	1350	1	900	
4/25/1995 0:00	21FLHILL24030007	1400	1	1300	
5/23/1995 0:00	21FLHILL24030007	1425	1	2200	
6/27/1995 0:00	21FLHILL24030007	1420	1	3100	
7/25/1995 0:00	21FLHILL24030007	1410	1	3600	
8/22/1995 0:00	21FLHILL24030007	1350	1	400	
9/26/1995 0:00	21FLHILL24030007	1400	1	5200	
10/24/1995 0:00	21FLHILL24030007	1350	3.25	2400	
10/24/1995 0:00	21FLHILL24030007	1350	3.3	2400	
11/28/1995 0:00	21FLHILL24030007	1415	3.5	2700	
12/12/1995 0:00	21FLHILL24030007	1336	3.5	1300	
1/23/1996 0:00	21FLHILL24030007	1330	3.3	1100	
2/20/1996 0:00	21FLHILL24030007	1410	3	700	
3/19/1996 0:00	21FLHILL24030007	1340	2.75	600	
3/19/1996 0:00	21FLHILL24030007	1340	2.8	600	
4/16/1996 0:00	21FLHILL24030007	1335	3	700	
5/14/1996 0:00	21FLHILL24030007	1405	2.5	800	
6/18/1996 0:00	21FLHILL24030007	1400	3.25	1900	

Date	Station	Time	Depth	Total Coliform	Remark Code
6/18/1996 0:00	21FLHILL24030007	1400	3.3	1900	
7/16/1996 0:00	21FLHILL24030007	1353	3	2000	
8/20/1996 0:00	21FLHILL24030007	1410	3	800	
9/24/1996 0:00	21FLHILL24030007	1340	2.8	500	
10/15/1996 0:00	21FLHILL24030007	1350	3	1400	
11/19/1996 0:00	21FLHILL24030007	1340	3.3	1400	
12/10/1996 0:00	21FLHILL24030007	1355	2.8	2800	
1/21/1997 0:00	21FLHILL24030007	1343	2.3	2000	
2/18/1997 0:00	21FLHILL24030007	1400	2.8	2000	
3/18/1997 0:00	21FLHILL24030007	1350	2	900	
4/15/1997 0:00	21FLHILL24030007	1315	2	3800	
5/20/1997 0:00	21FLHILL24030007	1350	2.3	1400	
6/17/1997 0:00	21FLHILL24030007	1445	2.5	500	
7/22/1997 0:00	21FLHILL24030007	1430	3	1400	
8/19/1997 0:00	21FLHILL24030007	1345	3.8	200	
9/16/1997 0:00	21FLHILL24030007	1320	3.3	300	
10/14/1997 0:00	21FLHILL24030007	1410	2.8	1100	
11/18/1997 0:00	21FLHILL24030007	1425	4	1000	
12/9/1997 0:00	21FLHILL24030007	1335	3.8	500	
1/20/1998 0:00	21FLHILL24030007	1310	3.5	800	
2/17/1998 0:00	21FLHILL24030007	1400	5	11500	
3/17/1998 0:00	21FLHILL24030007	1330	3.5	700	
4/21/1998 0:00	21FLHILL24030007	1428	3	1000	
5/19/1998 0:00	21FLHILL24030007	1432	2.5	800	
6/16/1998 0:00	21FLHILL24030007	1310	2.3	300	
7/21/1998 0:00	21FLHILL24030007	1332	3.3	20000	L
8/25/1998 0:00	21FLHILL24030007	1334	3.8	900	
9/15/1998 0:00	21FLHILL24030007	1441	3.8	600	
10/20/1998 0:00	21FLHILL24030007	1332	3.5	700	
11/17/1998 0:00	21FLHILL24030007	1345	3.5	600	
12/8/1998 0:00	21FLHILL24030007	1320	2.5	400	
1/19/1999 0:00	21FLHILL148	1340	2.5	600	
2/16/1999 0:00	21FLHILL148	1346	3.3	1200	
3/16/1999 0:00	21FLHILL148	1413	3	400	
4/20/1999 0:00	21FLHILL148	1335	3	200	
5/18/1999 0:00	21FLHILL148	1335	3	1000	
6/15/1999 0:00	21FLHILL148	1332	2.5	2300	
7/20/1999 0:00	21FLHILL148	1345	3.3	1900	
8/17/1999 0:00	21FLHILL148	1534	3.5	4400	
9/22/1999 0:00	21FLHILL148	1445	3	4100	

Date	Station	Time	Depth	Total Coliform	Remark Code
10/12/1999 0:00	21FLHILL148	1420	3.5	4200	
11/16/1999 0:00	21FLHILL148	1342	3.3	1400	
12/14/1999 0:00	21FLHILL148	1420	3.3	1900	
1/18/2000 0:00	21FLHILL148	1350	2.5	3400	
2/15/2000 0:00	21FLHILL148	1330	3	8800	
3/14/2000 0:00	21FLHILL148	1340	3	3400	
6/15/2000 0:00	21FLGW 8491	1115	0.05	2500	
6/15/2000 0:00	21FLGW 8496	1215	0.1	9000	
7/18/2000 0:00	21FLHILL148	1435	2.8	9200	
8/15/2000 0:00	21FLHILL148	1445	3	10200	
9/19/2000 0:00	21FLHILL148	1440	3.5	9600	
10/10/2000 0:00	21FLHILL148	1410	.	9300	
11/14/2000 0:00	21FLHILL148	1345	.	18400	
12/12/2000 0:00	21FLHILL148	1337	.	10500	
1/16/2001 0:00	21FLHILL148	1325	.	300	
2/20/2001 0:00	21FLHILL148	1332	.	2000	
3/20/2001 0:00	21FLHILL148	1303	.	15600	
4/17/2001 0:00	21FLHILL148	1422	.	3800	
5/15/2001 0:00	21FLHILL148	1335	.	15700	
6/19/2001 0:00	21FLHILL148	1435	.	10900	
7/24/2001 0:00	21FLHILL148	1349	.	13300	
8/21/2001 0:00	21FLHILL148	1400	.	12200	
9/18/2001 0:00	21FLHILL148	1405	.	11200	
10/16/2001 0:00	21FLHILL148	1347	.	3400	
11/13/2001 0:00	21FLHILL148	1411	.	5100	
12/11/2001 0:00	21FLHILL148	1357	.	7500	

Remark Codes: J – Estimated value

K – Actual value is known to be less than value given

L – Actual value is known to be greater than value given

U – Material analyzed for but not detected, value reported is minimum detection limit



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